Discussion of Thallium Issues

Thallium Issues

For a number of years, concerns have been voiced about the presence and concentrations of thallium in the landfill. As a result of this Chuck Budinger, a former member of the TAC, gave a presentation at the April 25, 2003, TAC meeting. The following section is taken directly from the minutes of that meeting:

"Chuck Budinger presented a thorough report regarding Thallium. He and Ann dePeyster, with help from Sylvia Castillo, prepared this item. Below are his conclusions and recommendations for consideration by the TAC for evaluating the presence of Thallium in the environment adjacent to the Mission Bay Landfill.

Conclusions

1. Thallium is not classifiable as a carcinogen, but has some toxic effects to humans in large ingested doses or in smaller doses to the skin. Some toxic effects include vomiting and diarrhea in lower doses, and liver and nervous system damage in long-term exposures at higher doses.

2. The No Observable Adverse Effect Level (NOAEL) is approximately 0.25 mg/kg/day-oral of body weight. NIOSH considers Thallium to be immediately dangerous to life and health at an exposure of 15 mg per cubic meter, over an 8-hour period. The Maximum Contaminant Level (MCL) established by the U. S. EPA is 2 parts per billion (ppb) and is the basic standard for drinking water quality. The most accurate Instrument Detection Levels currently in use are only to 5 ppb. A number of U. S. EPA testing methods have been used over the years through the various studies conducted at the landfill and over the period of time that the City has conducted its semi-annual monitoring plan for its Closure Permit issued by the Water Board. These testing methods produce different results and have differing detection limits associated with their use. Certain methods using light spectrometry can cause interference by other metals and lead to erroneous results, both for Thallium or the other metals.

3. Industrial uses for Thallium are wide spread, but its use was not particularly concentrated or in large volumes. Thallium can bond with a number of different compounds and molecules that have a variety of impacts on the user. These different compounds also have different solubilities in water. For example, oxides and acetates could be less soluble, while sulfates or other salts would be very soluble in water. So, the compound in use can impact the ability to migrate from the landfill.

Recommendations

1. The TAC should consider the use of only one testing method to be used for Thallium, and other metals as well. Currently, U. S. EPA Method 6020 uses Mass Spectrometry rather than light to determine concentrations of metals in water or soil. This produces less interference and results in a much better indicator of the true value of the concentrations of Thallium and other metals in the groundwater and soil.

2. The City should also reinstate, voluntarily, the program to sample and test for Thallium on a semi-annual basis with the other metals of concern using the 6020 Method. The City suspended sampling from twice a year to once every five years on recommendation by the San Diego Regional Water Quality Control Board. However, given the variety of testing methods and instrument detection limits associated with those methods, one consistent method should be used over the course of the ensuing investigation and at a more frequent rate. By increasing the frequency of sampling to semi-annual, we should be able to detect any minor trends in Thallium migration from the landfill more accurately.

3. In addition to the numerical analysis, a program for determining the impact on the aquatic "health" should be implemented. This would require a review of the pertinent literature describing the studies completed to date on the health of a variety of aquatic organisms and the development of a comprehensive toxicity study for the area around the landfill. Studies should include Master's and Ph.D. Theses from the local universities as well."

Analytical Data Interpretation

A table of thallium data in surface water, groundwater and sediment samples was compiled and provided by Sylvia Castillo of the City of San Diego. Some of these data are also included in the Master Data Compilation which was provided in the appendices of both the workplan and draft report. Additional thallium data for sediment samples collected in 1983 are also included in the master table. Soil and landfill waste samples had no thallium concentrations above the detection limit.

There is a clear pattern of detectable thallium in samples collected and analyzed during the mid 1980's and again in 1996. All of the other samples either had no detectable thallium or the detections were J-flagged by the laboratory, which means that the concentration was less than the detection limit and so is uncertain. It should be noted that for each sampling event, the reported concentrations for each of the samples with detectable thallium are remarkably similar. For example, in October 1985, there are two groundwater samples with concentrations of 1,000 µg/L thallium and two groundwater samples with concentrations of 1,100 µg/L thallium. During the same time period, there are three surface water samples with concentrations of 1,100 µg/L, and one with 600µg/L. In November 1986, the four surface water samples have reported thallium concentrations ranging from 270 to 340 µg/L, and the four groundwater samples have reported thallium concentrations ranging from 330 to 380 µg/L. The same pattern can be observed in the data for October 1983, May 1986, November 1987, October 1989, and for August and December 1996, which are the only sampling events for surface or groundwater with more than two reported detectable thallium concentrations.

It is our interpretation that the most likely explanation of these patterns is that they represent the type of interference described by Chuck Budinger during his presentation and in the conclusion above "*Certain methods using light spectrometry can cause*

interference by other metals and lead to erroneous results, both for Thallium or the other metals." The interference may occur due to the close proximity of the Thallium peak to those of other (more common) elements with higher concentrations. This has the effect of raising the base level of the spectrum, which may lead to misinterpretation of concentrations for the metal with the lower concentration (e.g. thallium).

It should be noted that the particular analysis for metals in groundwater that was used during this study was EPA Method 1669, rather than the method suggested by Mr. Budinger (EPA Method 6020). This was done because of the concern regarding the effect of the high salinity in the groundwater and the effect it is known to have on standard methods for metals analysis.

MISSION BAY LANDFILL
Thallium Results (ppb)

Surface Water Sample Results (µg/L)

	mbsw-1	mbsw-2	mbsw-3	mbsw-4	sdrsw-5	sdrsw-6	sdrsw-7	sdrsw8	sdrsw9
Oct-85					<500	600	1100	1100	1100
Nov-86					nd	340	320	330	270
Nov-87					<100	<100	170	<100	150
Sep-88					<100	<100	<100	<100	<100
Oct-89					230	290	170	180	160
Nov-90					<130	<130	<130	< 130	< 130
Nov-93	< 55	< 55	160	84	< 55	< 55	< 55	< 55	< 55
May-94	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55
Nov-94	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55
Nov-95	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
May-96	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Dec-96	10	10 (11)	< 5	9	< 5	7	5	6	< 5
Jul-03	< 5				< 5				< 5

Sediment Sampling Results (µg/kg)

	mb1	mb2	mb3	mb4	sdr5	sd6	sdr7	sdr8	sdr9
Oct-85	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Nov-86	nd	12	nd	nd	nd	nd	11	nd	nd
Nov-87	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Sep-88	< 20	< 20	< 20	25	< 20	< 20	< 20	< 20	< 20
Oct-89	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26
Nov-90	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26

Ground Water Wells (µg/L)

	MB-1	MB-2	MB-3	MB-4	MB-5	MB-6	MB-7	MB-10	Sea World GW LE-1	Sea World GW LE-4	Sea World GW LE-6
Oct-83	10	19	18	16		16	13	104			
Oct-85	1000	1100	1100	1000							
May-86	520	460	490	530							
Nov-86	330	350	380	360							
Nov-87	380	340	370	360							
Sep-88	<100	<100	<100	<100							
Oct-89	190	250	190	270							
Nov-90	<130	<130	<130	<130							
Nov-93	< 55	< 55	75	< 55	< 55	< 55	< 55	< 55			
Feb-94	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55			
May-94	< 55		< 55	< 55	< 55	< 55	< 55	< 55			
Aug-94	< 55	< 55		< 55	< 55	< 55	< 55	< 55			
Nov-94	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55			
Feb-95	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55			
May-95	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55			
Aug-95	< 55	< 55	< 55	< 55	< 55	< 55	< 55	< 55			
Nov-95	< 55	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
Feb-96	< 55	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
May-96	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
Aug-96	< 5	5	< 5	7	< 5	< 5	< 5	< 5			
Dec-96	5	6	< 5	15	15	19	17	< 5			
Feb-97	<100	<100	<100	<100	<100	<100	<100	<100			
Dec-97											
Mar-98											
Nov-98											
Nov-99											
Nov-00											
Jul-03	<5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Historical Documents Regarding Waste Discharge in San Diego